SELECTIONS FROM THE RECORDS OF THE BOM GOVERNMENT.

No. LXVIII.—New Series.

REPOR

ON

PROJECT FOR RECLAIMI

BETWEEN

BOMBAY AND T Y.

BY

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ACTING EXECUTIVE ENGINEER, NORTH

WITH A

MEMORAND

BY

LIEUTENANT-COLONEL A. D. LIS

CONSULTING ENGINEER FOR RECLAMATIONS.

THREE PLANS.

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Bombay

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ON

PROJECT FOR RECLAIMING LAND

BETWEEN

BOMBAY AND TROMBAY,

BY

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LIEUTENANT W. M. DUCAT,

ACTING EXECUTIVE ENGINEER, NORTHERN CONCAN DISTRICTS;

WITH A

MEMORANDUM,

BY

LIEUTENANT-COLONEL A. DeLISLE,

CONSULTING ENGINEER FOR RECLAMATIONS.

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REPORT

ON

PROJECT FOR RECLAIMING LAND

BETWEEN

BOMBAY AND TROMBAY.

HAVING been employed in the Bombay harbour for about three years under Captain (now Lieutenant Colonel) DeLisle, first on the survey and preparation of the Honorable A. Malet's reclamation scheme (now being executed by the Elphinstone Land Company), and afterwards on the defences of the Bombay harbour under the same officer, I have had many opportunities of observing the feature of the harbour, and among other points of remarking the quantity of silt deposited all along the Mazagon shore. The silting being evident, the next step is to trace the cause, and no great difficulty is experienced here in this case, as it becomes at once apparent to any one possessing the slightest knowledge of engineering, and having an opportunity of inspecting the land about the north of Trombay, that the cause may be traced to the construction of the causeway between Sion and Trombay, which interferes with the scour formerly existing round the latter island. On each side of this causeway a mud deposit has been formed, which is now in parts almost, if not entirely, free from the influence of the sea water. This deposit is annually on the increase, and will doubtless ultimately reach a limit between Peer Pan point and Mazagon, where, owing to the wash of the tide round the former point, no further tendency to silting will exist.

What first suggested the Project to me.

2. It is on this line then that I propose to construct a sea-wall of dressed stone to act as a bunder face, and behind which the deposit of silt will form a plain, which will, when fit for building purposes, be as valuable as almost any part of Bombay at present.

Site of face-wall.

3. The want of space in Bombay to meet the greatly increasing commerce of the port has for a long time been very much felt, and is likely to increase rather than decrease as Indian cotton rises in value and Bombay becomes, as it is gradually becoming, the commercial capital of British India. This reclamation will give about 17¾ millions of square yards for building purposes, roads, &c., and about 3¾ miles of wharfage. A large road might be opened through Mazagon, connecting this new town with the Elphinstone Land Company's reclamation, the proposed new Great Indian Peninsula Railway goods terminus, and in fact with the very centre of the commerce of the present town. A branch railway should be run from Coorla station through the centre of the new town down close to the wharf where large cotton storage grounds could be laid out. These, with properly laid-out roads throughout the new town itself, would at once establish its position and value, and no more would be heard for some years to come of the want of accommodation in Bombay.

The direct advantages to be derived from it.

4. The indirect advantages of the scheme are likewise of great importance. In the opinion of Dr. Leith, one of the ablest and most experienced medical officers in the service, expressed in his valuable report on the sanitary condition of Bombay, the existence of these marsh lands so near the town is most injurious, and the malaria arising from them should, if possible, be remedied. This would be one real benefit conferred on Bombay by this reclamation. At present the beautiful hill in the island of Trombay is so unhealthy as to be quite useless as a place of residence for either Europeans or natives, and is therefore left a mere jungle. This reclamation would turn this hill into a second Malabar Hill, and its value would be calculated by the square yard, instead of the acre as at present. To those conversant with Bombay the advantages to be derived from increased space for building houses for residence will not appear among the least of the recommendations to this reclamation when the present rate of house-rent on Malabar Hill is borne in mind. Its effect on Chinchpooglee hill would also be most beneficial.

The contingent advantages.

5. I have purposely omitted its anticipated effect on the harbour for reasons which will be stated hereafter.

6. No surveys or estimates for the scheme having been prepared, I have been obliged to take my measurements from the chart of the harbour, which being on a small scale cannot of course be depended on for any very great accuracy, but will nevertheless serve to give a rough idea of the cost likely to be incurred, and the returns which may be expected for the outlay. The length of the sea-wall I calculate to be about 6,600 yards, and I have assumed the probable cost per yard, including filling with earth for a width of 20 feet, to be about Rs. 630 on an average, or say 42 lakhs for the whole length. Allow in addition 3 lakhs for contingencies, and we have an outside total of 45 lakhs of rupees. As regards compensation due to owners of land bordering the reclamation for interfering with existing rights I have no means of calculating the amount, but as most of the sea-front is at present useless on account of the mud deposited along it I have assumed 15 lakhs as a round sum.

Probable cost.

7. To complete the project a main-drain on the site of the present creek, running up the centre of the marsh, should be converted into an arched-drain to carry off the surface drainage, and act as the main artery for a complete system of sewerage hereafter. I have estimated this roughly and consider that as much as 16 lakhs should be allowed for it.

8. In addition to the above we want the main roads laid out in the first instance to induce people to come to the new town. These roads I consider could be executed for Rs. 7,500 per mile, or say 3 lakhs for the total of roads.

9. These different items totalled up give us as follows :—

	Lakhs.
Sea-wall and filling	45
Compensation	15
Main-drain archwork	16
Main roads.....	3
Total....Lakhs	79

Amount of above in ten years at 5 per cent. about 125 lakhs.

10. In estimating the value of the sea frontage and most eligible building sites I have taken Rs. 20 per yard as the highest price, which is about one-fifth of the present price of similar sites in Bombay, old town, and fort. At this rate, which is, I think, very low, a sum of about 65 lakhs would be the value of

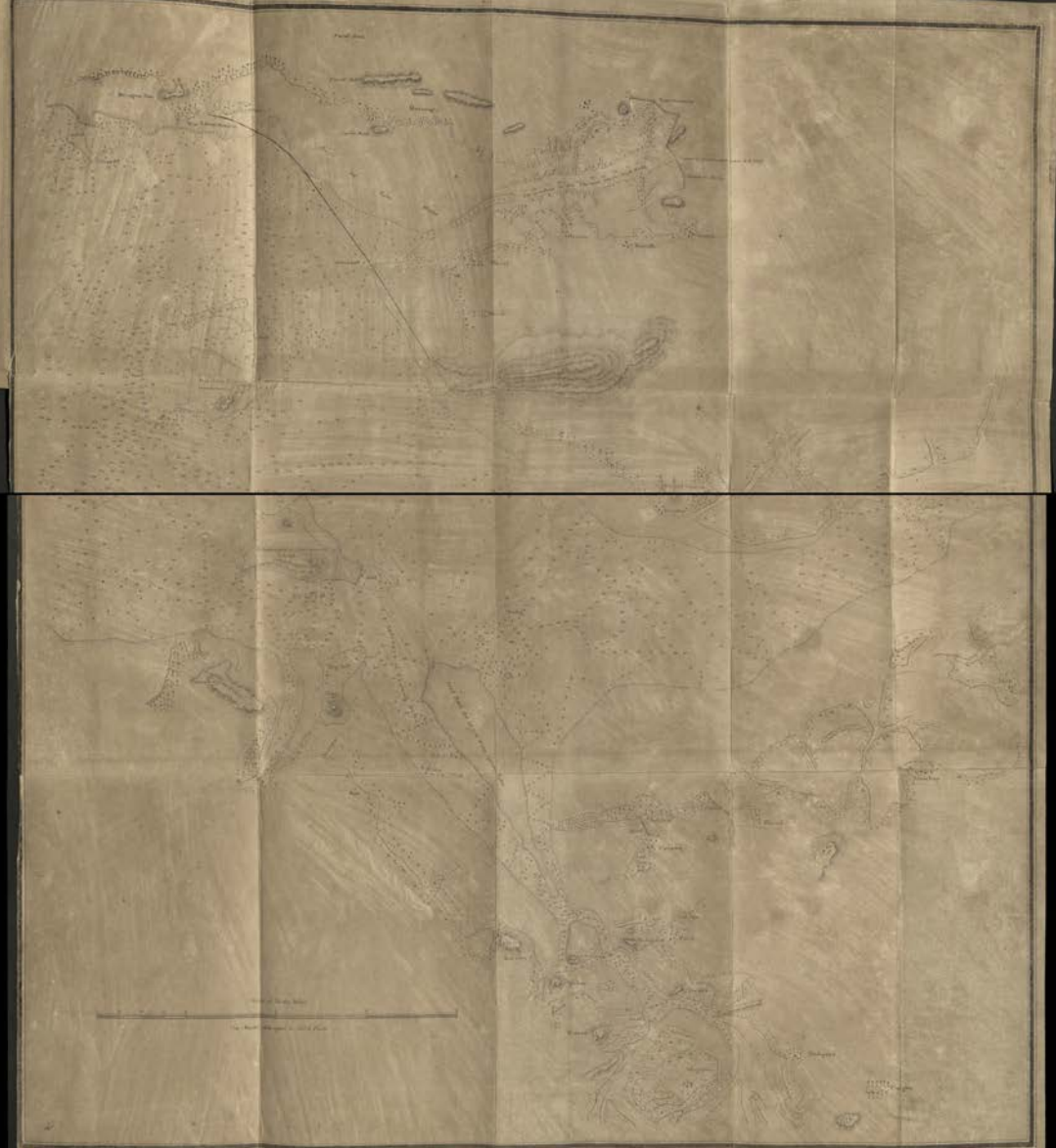
Probable return.

the bunder-face which I have assumed to be fifty yards wide. Next we have 1½ crore of rupees to be realised by the sale of the first row for warehouse buildings facing the wharf, and extending back for 100 yards in depth, call this 1 crore, which will leave a margin of nearly 30 per cent. for roads, &c. Assuming one-half this rate, or Rs. 10 a yard, for the remainder of the first quarter of a mile from the sea-face, we get about 1½ crore more. This leaves about 14¾ millions of yards to be disposed of. Of this say we omit the 4¾ millions, or nearly 50 per cent., for roads and other public purposes, and assume 4 annas a yard as a value for the remaining 10 millions of yards, this gives us 25 lakhs more; so that the grand total will stand thus—

	Lakhs.
Sea-front	65
1st class building-plots.....	100
2nd do. do.	150
3rd do. do.	25
Total....Lakhs	340

The method proposed for realising at first.

11. In stating the probable cost of the scheme I have taken the whole amount at 5 per cent. per annum, as I consider it better in the first instance to have the outside expenditure clearly borne in mind so that no disappointment may be felt hereafter. But in executing the work I consider that if well managed a sum of 50 lakhs would probably be the largest outlay necessary, and the returns from the land reclaimed for this sum be used to complete the project. In this way, although 80 lakhs will be necessary to complete the work and realise all its advantages, a capital of 50 lakhs will be sufficient to work it with. In carrying out the project I would propose at once to fill in the earthen embankment from both ends, viz. Mazagon and Trombay, leaving of course a large gap in the centre for the silting to go on, in order that the silting-up which will take a considerable time may commence as soon as possible; but the face-wall should be carried out from Mazagon only. After 10 lakhs have been expended on the sea-wall, I am of opinion that a return might be expected from that portion of the work adjoining Mazagon, which return will increase annually and most rapidly as the scheme approaches completion. The faster the work can be pushed on after it is once commenced the greater will be the return from it, as all its advantages cannot be realised until the work is complete. I do not think that any



one knowing the rising importance of Bombay and its daily increasing requirements would entertain any doubts as to the realisation at once of at least the two first items, namely, bunder-face and warehouse-room, and of the third item also in the course of a few years. The sea-frontage will be superior to that of any existing bunder in Bombay, having in places as much as three or four feet at low spring-tides, and the rate assumed for it is only Rs. 20 per yard; whereas Carnac Bunder and others which are quite dry at ordinary low tides stand at a value of about Rs. 120 per yard, or six times as high as the price I have put down. At these and even far high rates purchasers would not be wanting.

12. At first sight the project seems to offer too great advantages, and altogether to have too much the appearance of a bubble-scheme, and it was to obviate this as far as possible that I reduced my rate for bunder and first-class building-plots from Rs. 50, my first valuation, to Rs. 20 per yard. But when it is remembered that from the position of the sea-wall almost all outlay on "filling in" (which in these schemes is always the most important item) is obviated, the land reclaiming itself by silting up, and that a reclamation scheme, where this heavy expense has to be incurred, is nevertheless considered of a sufficiently remunerative character to be undertaken by a company of merchants in Bombay under the title of the "Elphinstone Land Company." When, I say, all this is fairly taken into account, the return, though calculated at nearly 300 per cent., does not appear so impossible.

Engineering difficulties.

13. In a previous section of this report I stated that "I purposely omitted to mention the anticipated effects of this reclamation on the harbour for reasons to be stated hereafter." It is of this subject that I now wish to treat here.

14. As regards the construction of the work up to this point no great difference of opinion can exist as to the possibility of overcoming all the engineering difficulties, the only doubtful point being the length of time required and the amount of artificial assistance necessary to fill in the reclamation with silt. But another question has to be mooted, the answer to which is not so easy, and the importance of which is so great as to make it in my opinion the turning point of the entire project. This question is, what effect will this reclamation have on the harbour?

15. To understand the few following remarks on this subject it will be necessary to refer to the accompanying sketch.

16. As a general rule the destruction of any backwater in a harbour is an error from which a tendency to silt is likely to result. This error was undoubtedly committed when the Sion and Trombay causeway was constructed, and all the backwater from the north of Trombay shut out from the general scour. This error being acknowledged (it is evident to anyone seeing the amount of mud deposited now), it at once becomes the duty of Government to rectify it in the best way they can before matters get worse. Two methods present themselves :—

First.—The channel might be reopened and the causeway carried over a bridge. This would ensure the scour, but would cost a considerable sum of money in bridges and cutting, which latter item will in a few years hence be much more heavy than it would be now, and consequently no time should be lost in ascertaining whether it will ultimately be necessary or not. Of course no money return will be derived from this.

Secondly.—The sea-wall that I propose might be built as shown in the drawing, with the view of inducing the backwater scour from Panwell river and the Tanna creek to follow the line of the wall round the south point of Trombay island. The only question to be decided is, will the current follow the wall, or will it not ? If the answer is, yes it will, the project should be carried out at once, not only as a paying scheme, adding very much to the importance of Bombay, but as a very necessary measure for the protection of the harbour itself. I consider that this wall if properly laid out will have this desired effect. The present flow of the current is, I believe, from Trombay point to some point near Cross Island on the east side; but the return of a large body of water like that from the site of the proposed reclamation, no matter how small its velocity, must have some influence in keeping the current away from the Mazagon shore; so that in its present state I consider the bay proposed to be reclaimed useless as a backwater (being too small to effect an efficient scour), and detrimental in excluding from the Mazagon shore the scour from the head of the harbour.

Value of this scheme compared with Back Bay scheme and others.

17. As just now the project for reclaiming Back Bay has been revived and is a good deal talked of, I will make a few remarks on the relative advantages of the two.

18. To begin with the face-wall. That of Back Bay if built of cut-stone will be a most costly undertaking, being required to resist the full force of the monsoon; and the annual cost of repairs will be a heavy item. This wall will be unsafe for any boat to moor alongside of except during the very calmest weather. If constructed of loose stones only, no boats can lie off it at all. The sea-wall in this project being at the most sheltered spot in the inner harbour, need be little more than an ordinary retaining-wall, and can be used at all seasons of the year, even during the monsoon if necessary; and from its face a pier can be built out hereafter, when funds are available, alongside of which the Peninsular and Oriental Company's steamers, or any vessel not drawing more than 20 feet of water, could lie.

19. In the next item ("filling in") Back Bay scheme is also at a disadvantage. The only means of filling in Back Bay would be by the Bombay, Baroda, and Central India Railway; and the nearest point from which to obtain ballast would be Salsette, which is all private property, and would have to be bought in the first instance, and carried such a distance afterwards as to make the cost of the filling-in alone (excluding the expenses of the face-wall) more than the value even in Bombay of the land when reclaimed. The advantages of this scheme have been already mentioned.

20. The value of the land in Back Bay would not be very great per yard: having no sea frontage the greater portion would be similar to land at Girgaum and Tardeo; that near the Fort and Colaba would of course realise large sums.

21. Its contingent advantages are none, but its effects on Bombay might be injurious. The wisdom of allowing the sea breeze into the Fort to be filtered through a mile or more of town before reaching its destination is very questionable, and its probable effect on the health of Bombay generally should be well considered. In this item, as in most others, the scheme forming the subject of this report has a most decided advantage.

Concluding remarks.

22. In the above remarks as much has been said about this project I think as can be safely assumed with the data we at present possess, but seeing the probable results promised by this reclamation, I hope to see more accurate surveys and estimate called for and prepared. I commenced the preparation of this report because I foresaw some of the advantages to be derived from the scheme, but the roughly-calculated results far exceed my most sanguine expectations.

23. Nothing further can of course be done in the matter until a more accurate estimate is obtained ; but as the cost of the survey is comparatively speaking very small, I trust His Excellency Sir Bartle Frere will consider it advisable to have the scheme properly prepared. The necessary capital of 50 lakhs though large might be easily obtained if Government felt sure of a return ; and if Government are unwilling to undertake the risk themselves, I have no doubt a Company would be formed either in Bombay or London who would willingly take up the scheme if submitted to them in an intelligible form. An officer might be appointed to survey and design the entire project in a sufficiently clear manner to enable any engineer to judge of the difficulties of the undertaking, and to give a professional opinion to any Company in London who might intend to speculate in land of this description. To give an idea of the value of the land when reclaimed the opinion of the Collector of Bombay and Tanna might be obtained, and perhaps at the request of Government the Chamber of Commerce might be induced to aid in forming a valuation. These two points (the cost and return) being settled by competent persons on the spot, sufficient data would be furnished to speculators at home to enable them to judge of the merits of the scheme.

24. As regards the probable effects on the harbour, a committee of engineers might be formed in Bombay to whom the question might be referred, or if Government preferred it, a plan of the harbour, showing the currents, &c., could be sent home, and the opinion of one of the first consulting engineers of the day be obtained.

25. Were these precautionary measures adopted no undue risk would be incurred by anyone undertaking the project, and the importance of Bombay as a commercial town would be very much increased.

WALTER M. DUCAT,

Acting Executive Engineer,
Northern Concan Districts.

No. 4 of 1862.

Public Works Department.

Memorandum on the Project of Lieutenant W. M. Ducat, R.E., *for Reclaiming the Land between Bombay and Trombay.*

For the sake of convenience the subjects will be taken in the same order as in Lieutenant Ducat's paper.

2. The cause of the present silting-up of this space is no doubt owing to the obstruction caused by the roadway from Koorla to Trombay. Only one archway has been allowed, probably for the purpose of allowing surface and tidal waters to escape.

3. There is, however, still a sufficient body of water at high-tide to afford an ebb-current of considerable power between Green Island and the Bombay coast line, and many years will yet elapse before the silting will have progressed so far as to render this current too feeble to prevent the silt extending along the fore-shore of Mazagon.

4. It is scarcely necessary to discuss the direct and contingent advantages Lieutenant Ducat states as likely to be obtained by this reclamation further than to mention that land in this locality is still too remote from the centre of trade to be as valuable as he supposes. Even at Mazagon land now sells at Rs. 4 to Rs. 6 per square yard if in a good situation, and is not worth more than Rs. 2 if off the roads.

5. It is probable that the extensive reclamation between Mazagon and the Castle will meet all the demands for space in Bombay for some years to come.

6. In estimating the probable cost of the sea-wall Lieutenant Ducat has taken the sea-wall and earth-filling for 20 yards behind it; but I do not see that he has anywhere estimated the expense of raising the general level to a certain height above high-water mark. This would require to be raised at least a yard and a half (4½ feet).

7. The mere silting-up would not be sufficient for building-grounds, for which purpose the surface must be raised to give a sufficient slope for drainage and to keep the buildings dry. Assuming the surface to be 16 millions of square yards, the quantity of filling required in addition to silt would be 24

millions of cubic yards, which, at 12 annas per yard, would cost 180 lakhs, and I need hardly say there would be some difficulty in procuring this enormous quantity of material.

8. The sea-frontage of the new sea-wall is exposed to the direct action of the waves in the monsoon. This would render extensive boat-harbours necessary to allow of the bay being used as a wharf, and of course increase the expense.

9. On the other hand the land along the wharves would not be so valuable to the mercantile public as ground nearer to the Fort. A merchant would not willingly lose a good portion of his day's work in going there to inspect a parcel of cotton; and even the Railway would hardly prove a remedy to this evil unless there were half-hour or hourly trains either way. I much doubt if this land would realise the prices assumed by Lieutenant Ducat, considering how large a space is yet available in the Bombay flats with the convenience of two main lines of railway passing through them.

10. The main objection to the project lies, I think, in the probable effect it would have on the harbour.

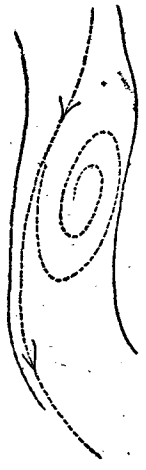
11. I have attached two tracings, one marked A, showing the direction of the present tidal currents in the harbour at ebb. It will be seen that the edge of the main current from Pan Pir Point in Trombay strikes outside Cross Island, and that the space between it and the coast of Bombay is filled up by the current from the bay between Bombay and Trombay. A minor current runs along the south face of Trombay as far as Green Island, where it meets the southward current and is deflected.

12. Now if the space between Bombay and Trombay be filled up two things may happen. *First*, The minor current may continue its flow along the new sea-wall to Mazagon and then along the sea-wall of the new reclamation; or *Secondly*, The main current may overpower the minor one and cause an eddy in the curve as sketched in the second tracing B. That it does not do so now is, I think, owing to the influence of the ebb from the body of water now existing in the backwater between Bombay and Trombay.

13. In the first case, which is the most favourable, and is that which Lieutenant Ducat anticipates, the current will be slower than the main current, and therefore likely to cause a deposit of silt along the new sea-wall and the Mazagon bunders as far as some point opposite Chinch Bunder.

14. In the second, which seems to be the more likely one to happen, the eddy will cause a considerable amount of deposit and render a great deal of dredging necessary to keep the wharves clear.

15. This might, perhaps, be obviated by a rough stone-groin from Butcher's Island to the reef, as indicated by a red line. This would tend to deflect the main current against the Bombay shore.



16. I give this opinion with much diffidence as there is always great uncertainty in determining the probable courses that water may follow. We know, however, that in rivers such as the Indus when the main current shoots across the river there is generally an in-shore eddy as sketched in the margin, and a clever commander takes advantage of this to hasten his voyage up the river.

17. On the whole I am of opinion that this reclamation would not be desirable if carried out in the mode proposed by Lieutenant Ducat.

18. The portions in the higher part of the backwater, which are only covered by two or three feet of water at spring-tides, might of course be reclaimed without doing much injury, and for this simple earthen embankments would probably be sufficient; but so far from reclaiming the remainder I would recommend that it be dredged to furnish materal for the reclamation now in progress. Every encouragement should be given to parties requiring material to procure it from this space.

19. A central channel should of course be preserved in the embanked portion to carry off surface-drainage.

20. Lieutenant Ducat gave me such able and willing assistance while employed under me in Bombay that it is with much regret I find myself compelled to give an unfavourable opinion on his project.

A. DeLisle, Lieutenant Colonel,

Consulting Engineer for Reclamations.

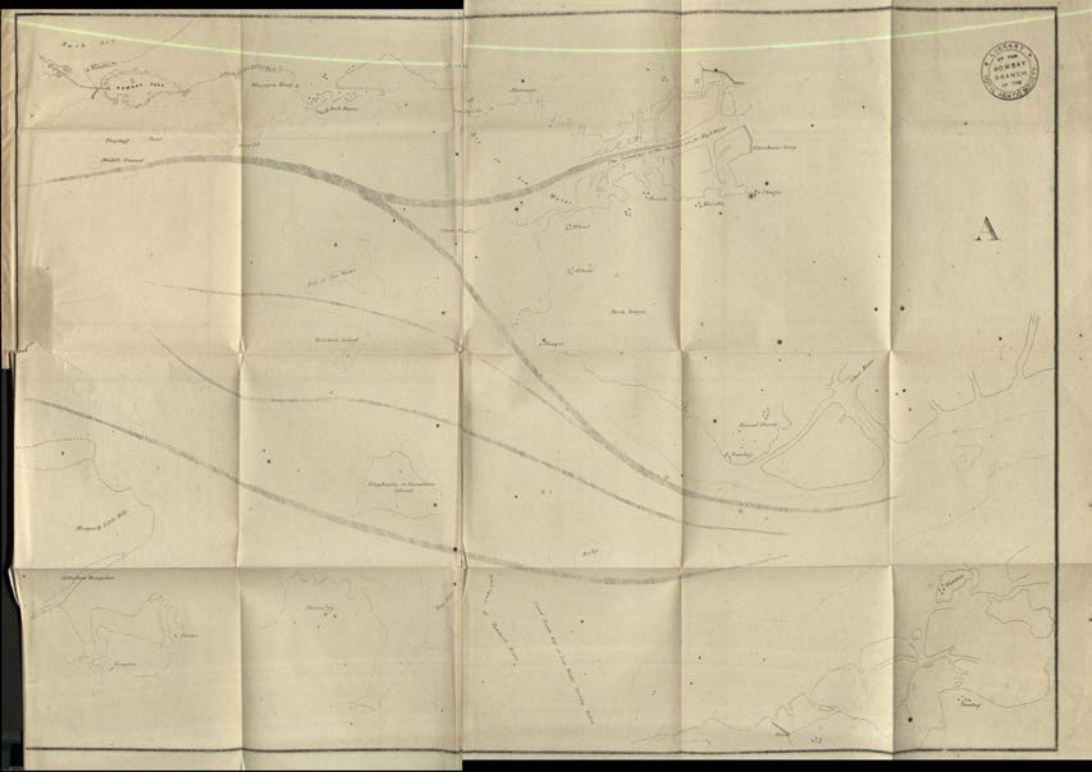
Bombay, 16*th December* 1862.

Resolution *of* Government, *dated the* 15*th January* 1863.

A copy of Lieutenant-Colonel DeLisle's report should be forwarded to Lieutenant Ducat.

2. Government are of opinion that Lieutenant-Colonel DeLisle's report is conclusive against agitating the question further.

3. But the reports of both Lieutenant-Colonel DeLisle and Lieutenant Ducat contain much which is incidentally valuable about the head of the harbour, and should be printed with plans in a volume of selections from the records of the Public Works Department.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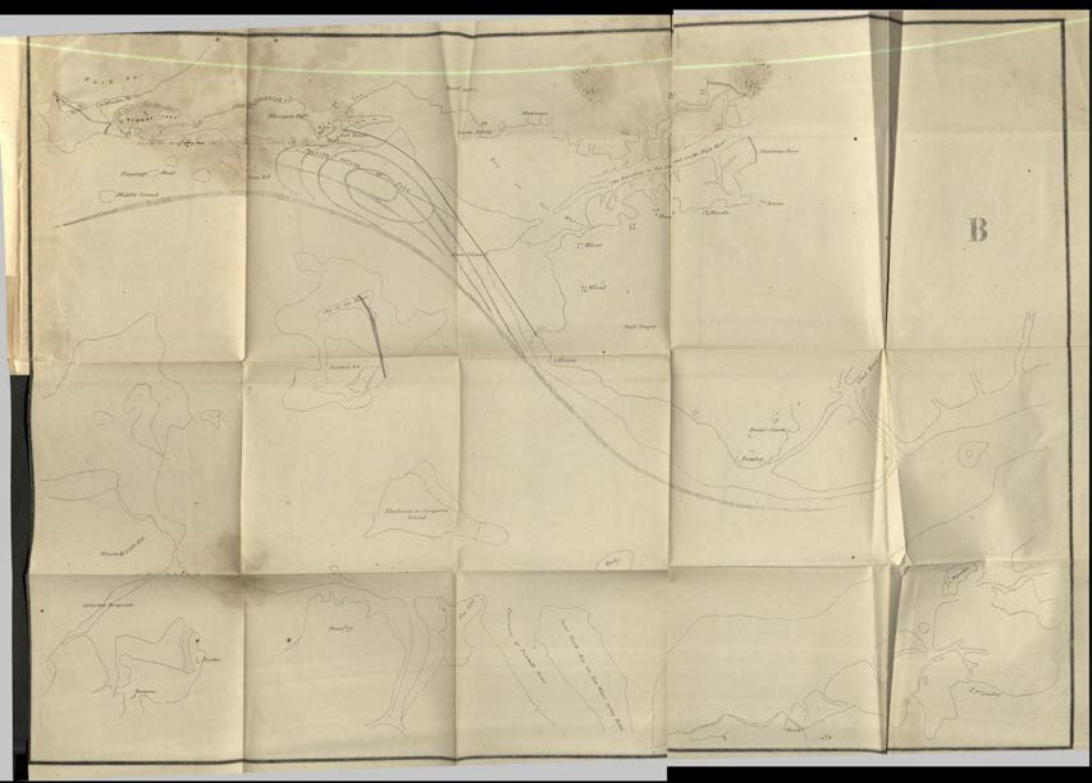
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